dispersive powers, accordingly, the unpolarized light which remains in the extraordinary image must be coloured at all incidences, the colours being most distinct near the maximum polarizing angle. This necessary result of the formula, the author finds to be experimentally true in oil of cassia, and various highly dispersive bodies; hence there can be no angle of complete polarization for white light.

The same law which determines the polarization of light by reflexion is applicable also to that by refraction; in both cases, the analysing doubly-refracting crystal is insufficient to distinguish light completely polarized from light in a state of approach to polarization. The difference, however, between these two kinds of light, is marked by most distinctive characters, and shows itself in some of the most complex phenomena of interference. Hence the author is led to consider common light as composed of rays in every state of positive and negative polarization, or of particles having planes, which are acted upon by the attractive and repulsive forces residing in solid bodies; such planes having every possible variety of inclination to a plane passing through the direction of their motion. The formulæ given in the paper represent the laws according to which the repulsive and attractive forces change the position of the planes of polarization; so that the author regards all the various phenomena of the polarization of light by reflexion and refraction, as now brought under the dominion of laws as well determined as those which regulate the motions of the planets.

A Report on the Stomach of the Zariffa. *By Sir* Everard Home, *Bart. V.P.R.S.* Read December 24, 1829. [*Phil. Trans.* 1830, *p.* 85.]

In common with other ruminant quadrupeds, the Zariffa has a stomach consisting of four cavities. The efflorescence which lines the paunch is similar to that of the bullock, but is more prominent; the second cavity is destitute of the cellular structure met with in other ruminants, but the third and fourth cavities exhibit no peculiarities; the cud formed from the leaves and twigs of the acacia, which are the natural food of the Zariffa, is so succulent, as not to require being again moistened in passing through the second stomach, as is the case with grass; this cavity is therefore not furnished with the cells which are provided for this purpose in herbivorous quadrupeds.

Three drawings of the structure of the parts described accompany the paper.

On the Production of regular double Refraction in the Molecules of Bodies by simple Pressure; with Observations on the Origin of the doubly refracting Structure. *By* David Brewster, *LL.D. F.R.S. L. & E.* Read February 11, 1830. [*Phil. Trans.* 1830, *p.* 87.]

The author has already shown, in former papers which have appeared in the Philosophical Transactions, that the phenomena of

double refraction may be produced artificially by effecting certain changes in the mechanical condition of hard and of soft bodies. In all these cases, he observes, the phenomena are entirely different from those of regular crystals; and in none of them is the doubly-refracting force a function of the angle which the incident ray forms with one or more axes given in position. In the year 1815, he noticed the depolarizing properties of a thin film of a mixture of resin and white wax, compressed between two pieces of glass. Accidentally meeting with the specimen which had originally been the subject of this observation, he found that after fifteen years it still retained this property of depolarization, and was induced to pursue the inquiry to which it led. He varied the proportions of the ingredients, and observed in the different cases the modifications produced in the phenomena by employing various degrees of pressure. He found that, in every point, there existed an axis of double refraction, perpendicular to the plane of the film, and that the doubly-refracting force varied with the inclination of the incident ray to this axis, just as happens with all regular uniaxal crystals. He infers from his observations, that the property of uniaxal double refraction is communicated to the molecules simply by the agency of pressure; for in all cases where pressure has not operated, the aggregate does not exhibit this property. These effects are precisely the same as those which would be produced by subjecting elastic spheres to a regular compressing force, the axis of pressure becoming an axis of positive double refraction; while extension, on the contrary, produces a negative axis.

From the consideration of the preceding facts, the author is led to a very simple explanation of the origin and general phenomena of double refraction in regular crystals. He considers this property as not being inherent in the molecules themselves, but as resulting from their compression, either by an extraneous force, or by their power of inherent attraction of aggregation. The phenomena of crystallization, and of cleavage, prove that the molecules of crystals have several axes of attraction, or lines, along which they are most powerfully attracted, and in the directions of which they cohere with different degrees of force. Guided by the indications of hemitrope forms, and supposing the molecules to be spherical or spheroidal, it is inferred that these axes are three in number, and at right angles to each other, and that they are related in position to the geometrical axis of the primitive form. In like manner, the phenomena of double refraction are related to the same axis of the primitive form, and may be all rigorously calculated by a reference to three rectangular axes. The author pursues the consequences of these principles in their application to various kinds of crystals. It follows from this theory, that the forms of the ultimate molecules of crystals, existing separately, determine, within certain limits, the primitive form to which they belong; while the doubly-refracting structure, and the precise form of the crystal, are simultaneously produced by the action of the forces of aggregation. These views receive a re-

markable confirmation in the doubly-refracting structure which the author discovered in chabasie; and they also enable us to understand the nature of that influence which heat produces on doubly-refracting crystals, as discovered by Prof. Mitscherlich. The optical phenomena exhibited by fluids under the influence of heat and pressure, and by crystals exposed to compressing or dilating forces, are also in perfect conformity with the above views, and would in themselves have been sufficient to establish the principle that the forces of double refraction are not resident in the molecules themselves, but are the immediate result of those mechanical forces by which these molecules constitute solid bodies.

Experiments on the Influence of the Aurora Borealis on the Magnetic Needle. By the Rev. James Farquharson, *F.R.S. Minister of Alford, Aberdeenshire. In Letters addressed to Captain* Edward Sabine, *Sec. R.S.* Read January 28, March 4, and April 1, 1830. [*Phil. Trans.* 1830, *p.* 97.]

In the first letter, dated from Alford, Dec. 15, 1829, the author gives a description of the instrument which was furnished to him by the Royal Society for measuring the variation of the magnetic needle, and also the magnetic intensity; and of his mode of using it. The needle was so delicately suspended as to render changes in the declination as small as $10''$ very sensible. In his experiments on the magnetic intensity, the intervals of time occupied in the needle's performing 50 oscillations, commencing with an arc of 12°, were noted by a stop-watch, in which the stop, being applied on the balance, is instantaneous in its operation. The watch is again released from the stop at the commencement of a new observation; thus compensating, on the principle of the repeating circle, for any inaccuracy in the reading off, or any inequality in the divisions of the dial-plate.

The observations made on an Aurora borealis which appeared on the night of the 14th of December, are particularly detailed. On that occasion, the disturbance of the magnetic declination was so great, and so frequently changing from east to west, and the reverse, as to leave no doubt in the mind of the author of the reality of this influence. The needle, however, was affected at those times only when the fringes of the aurora were in such a position as to include the needle in their planes. It appeared to him, also, that the side towards which the needle declined, was the quarter where the aurora gave out the most vivid light.

His experiments on the oscillations of the needle have not yet enabled him to determine satisfactorily, whether any change of magnetic intensity accompanied these changes of direction.

In a second letter, dated December 26, he gives the results of later observations. From a comparison of his own with the observations of the Rev. James Paull, minister of Tullynessle, he infers that the height of the particular aurora which was seen by them on the 20th, did